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SUPPLY CONTROL STUDY INSTABILITY.(U)
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IRO REPORT NO. 285

SUPPLY CONTROL
STUDY INSTABILITY

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JUNE 1981

ROOM 800
U.S. CUSTOM HOUSE
2nd and Chestnut Streets
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report deals with instabilities in computer-recommended supply actions in successive supply control studies ---- where the recommended action can change from buy to cutback, cutback to buy, etc., from one study to the next. Statistics are given on the magnitude of the problem at the DARCOM MRCs and on most frequently encountered causes. Some recommendations to improve the situation are given.

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SUMMARY

1. Background

Item Managers have been troubled for some time by the fact that successive Supply Control Studies done in the Commodity Command Standard System (CCSS) will often recommend diametrically opposed supply actions - a Buy recommendation on one study followed by a Cut-Back recommendation on the next, and so on. These instabilities require Item Managers to spend considerable time trying to verify if the recommended reversal action is valid. Frequently it is not and, if this is the case, the question is: What is happening in CCSS, or in the interface between Item Manager and the computer, that causes an erroneous action recommendation to be generated? Even if the recommended action is found to be correct, a question exists: Is the Supply Control Study system too sensitive to changes? Should the system be damped in some way so that supply action changes, which represent an annoying workload in the procurement and accounting functions as well, do not occur so frequently?

This problem has been a source of complaints for years but has never, to our knowledge, been studied in a systematic way.

2. Study Objectives

Determine what the major causes of study instability are; recommend corrective actions, where possible, either in CCSS or in ADP/Item Manager interface procedures, as appropriate.

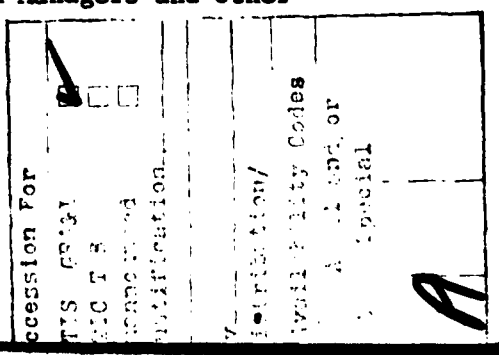
3. Scope of The Study

Problem is DARCOM-wide.

4. Methodology

First, a program written by ALMSA was run at all Commands to obtain statistics on the severity of the problem and to identify individual items that had experienced "flip-flop" supply action recommendations over the past year.

Then, Supply Control Study folders of a sample of items that had experienced the problem most frequently were reviewed at TSARCOM, TACOM and CECOM. Causes were identified, where possible, with the help of Item Managers and other Command personnel.



5. Findings/Conclusions

Statistics shown below in Table 1 indicate that the instability problem is pervasive at all Commands. They show the percent of all Supply Control Studies recommending a supply action in which the recommended action was a reversal of the preceding recommendation (Buy to Cutback, Cutback to Buy, etc.).

TABLE 1

FREQUENCY OF "FLIP FLOP" SUPPLY ACTIONS (PERCENT)

	ARRCOM	CECOM	MICOM	TACOM	TSARCOM
LDV Items	6.2	2.4	7.2	10.4	9.1
MDV/HDV Items	15.2	8.5	15.8	16.4	10.9
TOTAL	9.3	5.0	11.1	11.7	10.0

Most frequently encountered cause of instability was difficulty in entering and keeping the programmed and non-recurring requirements in Sector 13. This process is largely manual and subject to human error. In view of the high error rate, the value of trying to maintain requirements in so detailed a fashion may be open to question. This is a subject to be looked into in another IRO study.

Sudden changes in ALT/PLT values was another frequently encountered cause. These changes are due to use of the most recent representative value being used. Large changes in ALT and PLT were observed from one procurement action to the next, causing large levels changes and thus changes to recommended supply actions. This condition will be alleviated when SCR allowing use of average ALT/PLT is implemented.

Procurement Cycle changes due to use of "Buy-Ahead" at TSARCOM was found to be causing a large number of action reversals. Continued use of this policy should be reexamined, not only because of its effect on study stability, but also because adherence to prescribed policies will yield better results.

Errors in Due In/Due Out files continue to cause difficulities. Again, these are most likely caused by human error, and little can be done about them at this time.

Some minor systems problems were found for which corrections will be recommended in SCRs.

ACKNOWLEDGEMENTS

Most valuable assistance was provided by personnel at CECOM, TACOM and TSARCOM during the course of this project. In addition to the Item Managers who gave of their time and knowledge in interpreting and explaining conditions found in supply control study folders, I want also to express thanks to the systems people - Tom Castro at CECOM, Chico Deary at TACOM and Harold Lacy at TSARCOM, who spent considerable time with me guiding me through the intricacies of the CCSS supply control process. Special thanks are due Mr. Lacy for taking on the additional chore in getting TSARCOM Item Managers to do a good part of the data extract at that Command and in giving them the guidance and assistance they needed that led to their work being so excellently done.

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CHAPTER I

STATISTICS ON FREQUENCY OF STUDY ACTION INSTABILITY

A computer program was written by ALMSA to access Sector 26 of the NSNMDR to look for NSNs on which the recommended Supply Action changed on successive Supply Control Studies in the past year. Each instance was classified as to type of "flip-flop", as follows:

Buy to Cutback
Cutback to Buy
Buy to Excess
Excess to Buy

A count was maintained of the number of occurrences of each type for the stock number and the dollar value class of the item (Low, Medium/High Dollar Value) at the time of the second study of the flip-flop pair. The elapsed days between the successive studies in the flip-flop pair was also tabulated along with the number of ADP-generated Supply Control Studies that recommended supply actions.

After this was done for each NSN experiencing at least one "flip-flop" in the past year, the statistics were summarized for each Command. The summarized statistics are at Tables 2 through 6.

The program also produced an output listing of the first 1000 NSNs at each Command that had experienced two or more reversals in the past year. Complete statistics as shown in Tables 2 through 6 were printed for each of these NSNs. These listings were used to select individual NSNs for analysis.

As can be seen, Buy to Cutback and Cutback to Buy are the predominant "flip-flop" pairs, a not unsurprising finding. What is somewhat surprising is that the overwhelming proportion of supply action reversals occur in less than 60 days.

TABLE 2

"FLIP-FLOP" STATISTICS BY COMMAND

ARRCOM

LDV SUMMARY

NUMBER OF ACTIONS	ACTION SEQUENCE	NUMBER OF INSTANCES	%	NUMBER OF INSTANCES WHEN DAYS BETWEEN ACTIONS WAS				
				<30	30-59	60-89	90-120	>120
28870	BUY/CUTBACK	1015	3.5	-	495	157	141	222
	CUTBACK/BUY	781	2.7	-	321	155	95	210
	BUY/EXCESS	3	-	-	2	-	1	-
	EXCESS/BUY	20	-	-	8	4	2	6

HDV SUMMARY

14132	BUY/CUTBACK	1119	7.9	-	663	159	138	159
	CUTBACK/BUY	1019	7.2	-	622	149	117	131
	BUY/EXCESS	11	-	-	5	-	2	4
	EXCESS/BUY	13	-	-	11	-	1	1

TOTAL: 43002 3981 9.3

TABLE 3

"FLIP-FLOP" STATISTICS BY COMMAND

CECOM

LDV SUMMARY

NUMBER OF ACTIONS	ACTION SEQUENCE	NUMBER OF INSTANCES	%	NUMBER OF INSTANCES WHEN DAYS BETWEEN ACTIONS WAS <30	30-59	60-89	90-120	>120
43336	BUY/CUTBACK	589	1.4	20	248	89	64	168
	CUTBACK/BUY	372	1.0	8	187	51	41	85
	BUY/EXCESS	44	-	1	22	2	1	18
	EXCESS/BUY	32	-	1	8	8	2	13

HDV SUMMARY

31169	BUY/CUTBACK	1529	4.9	129	554	377	192	277
	CUTBACK/BUY	983	3.2	54	399	195	117	218
	BUY/EXCESS	74	-	3	31	5	6	29
	EXCESS/BUY	78	-	9	24	24	7	14
TOTAL: 74505		3701	5.0					

TABLE 4

"FLIP-FLOP" STATISTICS BY COMMAND

MICOM

LDV SUMMARY

NUMBER OF ACTIONS	ACTION SEQUENCE	NUMBER OF INSTANCES	%	NUMBER OF INSTANCES WHEN DAYS BETWEEN ACTIONS WAS <30	30-59	60-89	90-120	> 120
27149	BUY/CUTBACK	1076	4.0	329	301	136	154	156
	CUTBACK/BUY	552	2.0	127	112	69	73	171
	BUY/EXCESS	144	1.0	19	25	11	23	66
	EXCESS/BUY	172	1.0	27	21	11	40	73

HDV SUMMARY

22962	BUY/CUTBACK	1943	8.5	593	622	299	204	225
	CUTBACK/BUY	1463	6.4	481	388	180	182	232
	BUY/EXCESS	111	-	30	24	13	19	25
	EXCESS/BUY	118	1.0	17	34	17	27	23
TOTAL: 50111		5579	11.1					

TABLE 5

"FLIP-FLOP" STATISTICS BY COMMAND

TACOM

LDV SUMMARY

NUMBER OF ACTIONS	ACTION SEQUENCE	NUMBER OF INSTANCES	%	NUMBER OF INSTANCES WHEN DAYS BETWEEN ACTIONS WAS <30	30-59	60-89	90-120	>120
82285	BUY/CUTBACK	4784	5.8	1000	1588	597	945	654
	CUTBACK/BUY	3340	4.1	702	923	450	388	877
	BUY/EXCESS	122	-	29	45	9	13	26
	EXCESS/BUY	307	-	33	48	47	38	141

HDV SUMMARY

23070	BUY/CUTBACK	1873	8.1	390	679	316	213	275
	CUTBACK/BUY	1558	6.8	325	454	234	170	375
	BUY/EXCESS	150	1.0	35	58	10	15	32
	EXCESS/BUY	201	1.0	57	47	28	14	55

TOTAL: 105355 12325 11.7

TABLE 6

"FLIP-FLOP" STATISTICS BY COMMAND

TSARCOM

LDV SUMMARY

NUMBER OF ACTIONS	ACTION SEQUENCE	NUMBER OF INSTANCES	%	NUMBER OF INSTANCES WHEN DAYS BETWEEN ACTIONS WAS				
				<30	30-59	60-89	90-120	>120
47096	BUY/CUTBACK	2675	5.7	809	630	378	406	452
	CUTBACK/BUY	1456	3.1	455	398	221	123	259
	BUY/EXCESS	46	-	11	8	9	5	13
	EXCESS/BUY	89	-	27	11	17	8	26

HDV SUMMARY

21885	BUY/CUTBACK	1339	6.1	514	455	176	120	74
	CUTBACK/BUY	859	3.9	266	217	145	86	145
	BUY/EXCESS	93	-	41	23	3	17	9
	EXCESS/BUY	100	-	13	31	15	03	38

TOTAL: 68981 6657 10.0

CHAPTER II

REASONS FOR SUPPLY ACTION REVERSALS

Supply Control Study folders of selected NSNs that had experienced three or more reversal actions in the past year were reviewed in an attempt to find the causes of these action reversals. This was done at three Commands; CECOM, TACOM and TSARCOM. Sample NSNs were selected by the Commands, with about 2/3 being Low Dollar Value items (annual demand less than $5,000), the remaining 1/3 being Medium and High Dollar Value items.

Data were extracted from the Supply Control Study folders as shown in the form in Figure 1. Data from the two most recent "flip-flop" studies were entered in columns 1 and 2, with the most recent study data entered in column 1. Earlier "flip-flop" study data were entered in columns 3 through 6, as necessary. Remarks appearing in the Supply Control Study folders attributed to Item Managers and supervisors were entered in digested form in the "REMARKS" section of the form when pertinent to explanation of study actions recommended and taken. Extraction of the data was done entirely by the author of this report at CECOM and TACOM; Item Managers at TSARCOM did the data extraction on about 2/3 of the NSNs at TSARCOM.

In some instances, Item Managers were queried when the record in the Supply Control Study folder did not suffice to explain the sequence of supply actions recommended and taken. And, in some cases, functional systems personnel, as indicated in the "Acknowledgements" section of this report, were interviewed to determine how the CCSS programs could produce the observed study actions sequence.

Analysis of data extracted from the folders enabled us to classify the reversal action causes as shown in Tables 7, 8 and 9.

It will be noted that the number of causes exceeds the number of NSNs at all Commands. This is due to some action reversals being attributed to more than one cause. For example, an item might have switched from a Buy to a Cut Back recommendation because initial issue requirements were lost and because of an error in Due-In files.

Discussion of the action reversal causes now follows:

a. Rebuild Requirements Added/Deleted

This has to do with difficulties experienced in the CCSS parts explosion process and in entering and keeping the proper requirements in Sector 13.

NSN: NOMENCLATURE:

	STUDY NO.					
	1	2	3	4	5	6
DATE						
UP						
SL						
ALT						
PLT						
PRO CYC						
AMD						
% RBLD						
% WASHOUT						
λ						
STUDY ACTION						
SMC						
IMPC						

REMARKS

FIGURE 1

DATA EXTRACT FORM

TABLE 7

REASONS FOR SUPPLY ACTION REVERSAL

CECOM - 36 NSNs

Rebuild Requirements Added/Deleted	XXX	(3)
Other Program Demand Added/Deleted	XXXXXXXXXXXXXXXXXXXXXXXXXX	(26)
Large ALT/PLT Change	XXXXXXXXXXX	(11)
Procurement Cycle Change	XXXXXX	(6)
PWD Not Entered in CCSS in Time	XXXXX	(5)
Manual AMD Change	X	(1)
Sudden AMD Change	X	(1)
Sudden Change in Assets	X	(1)
Item Migration	X	(1)
Error in Due In/Due Out Data	XXX	(3)
Miscellaneous	XX	(2)

TABLE 8

REASONS FOR SUPPLY ACTION REVERSAL

TACOM - 41 NSNs

Rebuild Requirements Added/Deleted	X	(1)
Other Program Demand Added/Deleted	XXXXXXXXXXXXXX	(15)
Large ALT/PLT Change	XXXXXXXXX	(9)
Procurement Cycle Change	XXXXXX	(6)
PWD Not Entered in CCSS in Time		
Manual AMD Change	XXXXXXXX	(8)
Sudden AMD Change	XXXXXXX	(7)
Sudden Change in Assets	XXXX	(4)
Item Migration	XXXXXX	(6)
Error in Due In/Due Out Data	XXXXXXXX	(8)
Miscellaneous	XXX	(3)

TABLE 9

REASONS FOR SUPPLY ACTION REVERSAL

TSARCOM - 60 NSNs

Rebuild Requirements Added/Deleted	XXXXXXXXXXXXX	(14)
Other Program Demand Added/Deleted	XXXXXXXXXXX	(12)
Large ALT/PLT Change	XXXXXXXXXXXXX	(13)
Procurement Cycle Change	XXXXXXXXXXXXXXXXXXXXXXXXX	(25)
PWD Not Entered in CCSS in Time	XX	(2)
Manual AMD Change	XXX	(3)
Sudden AMD Change	XXXX	(4)
Sudden Change in Assets	XXX	(3)
Item Migration	XXX	(3)
Error in Due In/Due Out Data	XXXXXXXXX	(9)
Miscellaneous	XXX	(3)

TABLE 9A

REASONS FOR SUPPLY ACTION REVERSAL

CECOM, TACOM AND TSARCOM COMBINED (137 NSNs)

Rebuild Requirements Added/Deleted	XXXXXXXXXXXXXXXXXX (18)
Other Program Demand Added/Deleted	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXX (53)
Large ALT/PLT Change	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX (33)
Procurement Cycle Change	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX (37)
PWD Not Entered in CCSS in Time	XXXXXXX (7)
Manual AMD Change	XXXXXXXXXXXX (12)
Sudden AMD Change	XXXXXXXXXXXX (12)
Sudden Change in Assets	XXXXXXXX (8)
Item Migration	XXXXXXXXXX (10)
Error in Due In/Due Out Data	XXXXXXXXXXXXXXXXXXXX (20)
Miscellaneous	XXXXXXXX (8)

In TSARCOM's case, significant changes in rebuild programs were also taking place. Rebuild requirements changes emanating from Air Force and Navy were the major cause of a supply action reversal in many of these cases.

b. Other Programmed Demand Added/Deleted

This condition was encountered mostly on initial provisioning items and involved difficulties in getting proper requirements into Sector 13 and keeping them there while they were in effect. Similar difficulties were also encountered, mostly at CECOM, on set assembly requirements.

c. Large ALT/PLT Changes

This condition is caused by the current CCSS program logic, which overlays the most recent "representative" ALT/PLT value as procurement actions are processed. This causes requirements levels to change suddenly, both up and down, when a new value differs greatly from the value currently in file.

There is a SCR already approved by the Supply Management FCG to allow use of an average ALT/PLT. This would alleviate this condition.

d. Procurement Cycle Changes

These changes can be caused by item migration between dollar value classes because of the difference in procurement costs used in the VSL/EOQ module. However, in TSARCOM's case, the large number of reversals in this category were due to their "Buy Ahead" program. Here, ADP-computed Procurement Cycles were over-ridden and replaced by buy quantities sufficient to last for the balance of the fiscal year. These new procurement cycles were not frozen in Sector 13. The next study would then compute a smaller procurement cycle, causing the Requirements Objective to drop, with a resulting Cut Back recommendation.

e. PWD Not Entered in CCSS in Time

This condition arises when, for any one of a variety of reasons, the PWD input doesn't "take." The next study recommends a buy again which is also processed. When both PWDs "take," the item can then have reached a Cut Back condition.

f. Manual AMD Change

Conditions were noted when a manual change had been made to the AMD in a previous study which was either not "frozen" or where another "freeze" was not instituted when it expired. Resulting levels changes then caused the reversals in supply actions.

g. Sudden AMD Change

The instances where this was noted were due either to very erratic demand patterns or, in a few cases, when an item had a very large demand in its oldest month of demand history. When this demand was dropped, a large change in AMD resulted, causing a corresponding levels change.

h. Sudden Change in Assets

The few cases where this occurred could not be explained - asset balances just suddenly changed from one study to the next. Inventory adjustments could have been the reason but time was not taken to track this down.

i. Item Migration

These were changes in supply action when an item moved from non-stocked to stocked or vice versa.

j. Error in Due In/Due Out Data

These cases usually involved requisitions or backorders that the Item Manager stated should have been in or out of the files.

k. Miscellaneous

The conditions placed in this category were as follows:

(1) NSN was a terminal item; IM manually entered a Requirements Objective to retain assets.

(2) Cancellation of a large customer requisition.

(3) Change in Prime/Related item relationship, resulting in a large AMD change in the next DRD run.

(4) Change in recoverability code.

(5) IM for some reason reduced the length of the demand base period not realizing that it would affect the demand forecast.

In addition to the above conditions, a few occurrences were found that were directly traceable to the CCSS program. They were very odd cases involving provisioning items still in the initial support period. They were as follows:

a. Item was initially coded as an Insurance Item and thus had a zero Failure Factor 1. Demands began to come in, however, and it migrated first to a LDV, then to a MDV item. When it migrated to MDV, the CCSS program used Failure Factor 1 to compute a weighted Program Change Factor. Since Failure Factor 1 was zero, a PCF of zero was computed and the demand forecast was thereby wiped out.

This condition can be easily corrected by having a "fall-back" value of 1.0 provided for cases where the Failure Factor 1 is missing. CECOM, where this condition was encountered, is submitting a SCR to make this change.

b. A second case, also encountered at CECOM, was more subtle. It again involved an initial provisioning item that migrated from LDV to MDV during the initial support period. All requirements disappeared after the migration and the Engineered AMD was observed to be zero. An error message output stated that an error in the Program Data File existed. Manual review of the PDF showed, however, that it seemed to be in order.

CECOM reported the condition to ALMSA, which is to provide them with a linkage program to enable them to examine intermediate computational results so that further efforts to track down the cause can be made.

CHAPTER III

CONCLUSIONS AND RECOMMENDATIONS

Aside from the two systemic problems described in Chapter II, which are of minor consequence owing to the infrequency of their occurrence, the CCSS supply management applications seem to be functioning as intended. The problem of sudden changes in ALT/PLT caused by use of the most recent "representative" buy should be significantly alleviated when the SCR allowing use of average values is implemented.

Most serious are the problems caused by programmed demands, including rebuild, set assembly and initial issues. These demands, by their very nature, are likely to be "lumpy," and requirements levels are therefore subject to sudden and large changes as they enter and leave Sector 13. This is compounded by the fact that entry, maintenance and deletion of these requirements depend heavily on manual actions and are thus subject to human error. One assumption implicit in projecting these requirements by month is that they are predictable both as to quantity and timing. Such an assumption may not be tenable, given the conditions found in this study. There is an IRO study (Project No. 278, Supply Performance Indicators),* in which the benefits of computing requirements in this way will be measured; these results will give special focus to that work.

Changes in AMD and Procurement Cycle as a cause of study instability almost always resulted from a previous Item Manager action to over-ride the ADP-computed values. The basis for the Item Manager over-ride was often not apparent in the supply control study folder. It is recognized, however, that all Commands maintain surveillance of Item Manager "freeze" actions and the number of instances encountered in this study indicate that they are, indeed, not an issue.

One finding deserves special mention and that is the continued use of the "Buy Ahead" policy at TSARCOM. Its continued use is something of a surprise, since it was resorted to as a special measure several years ago when Procurement offices had very large processing backlogs, and was, we thought, to be abandoned as soon as the Stock Availability crisis passed. Aside from the fact that the policy is in violation of AR710-1 and DoDI 4140.39, it leads, in the longer run,

*This project is temporarily suspended due to the press of higher priority work but is expected to be resumed in FY82.

to inventory investments that are not cost-effective - that is, investment of the same amount of money by use of the VSL/EOQ module would yield better Supply Availability. The instability of supply control study actions found in this study to result from use of "Buy Ahead" should serve as an additional reason to reconsider its continued use.

Errors in due in/due out files continue to be a cause of instability. However, nothing of a systemic nature was observed, and it is believed that they continue to be caused largely by human error. Increasing use of on-line edit procedures as we go into broader use of terminals under Distributed Functional Processing should provide a promise of improvement in the future.

Item migration was not found to be as frequent a cause of study instability as expected. Moreover it was the change from "Stocked" to "Non-Stocked" rather than migration from one dollar value class to another that was the more frequently encountered condition leading to a supply action "flip-flop." However, the cases seen were legitimate changes in item status and call for no remedy.

Finally, mention should be made of the Economic Procurement Cut-Back rule* that is imbedded in the CCSS supply management system. This formula suppresses a cut-back recommendation when such action is uneconomical. Some feeling had been expressed that the rule was not stringent enough and that a more sophisticated model might have to be considered. However, most of the cutback actions observed in this study were cases where expected requirements changed so radically that a cut-back action would not have been suppresed on economic grounds.

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*See "Economic Procurement Cutback Rule," by W. Karl Kruse, US Army Inventory Research Office, Technical Report TR 78-2, October 1977 (AD-A046617).

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